BRAKE OVERSTROKE INDICATION SYSTEM

BACKGROUND OF THE INVENTION

[1] The present invention relates to a disc brake assembly, and more particularly to an indicator system for disc brake air chamber overstroke.

[2] Heavy-duty vehicles are typically equipped with a pneumatic brake actuating system. The brake actuating system applies air under pressure to a service chamber of a brake actuator to move a diaphragm and a push rod connected to a linkage which actuates the vehicle brakes. An emergency chamber having a power spring and a second diaphragm is often mounted on the service chamber. The emergency chamber drives the push rod and actuates the brakes to provide redundant failsafe braking.

[3] A brake actuator push rod has a predetermined amount of available movement or stroke. The amount of movement required to fully actuate the braking system of the vehicle is monitored to assure that it remains within the available stroke of the push rod. Excessive stroke of the push rod can result due to factors such as brake lining wear and loosening of mechanical linkages between the push rod and brake linkages. These factors may sometimes cause excessive push rod stroke, which is typically referred to as "overstroke."

[4] Various mechanical monitoring systems have been utilized to monitor push rod stroke during actuation of the brake and provide some indication to an operator as to when there is an overstroke occurrence. One known mechanical system includes a brightly colored ring painted on the push rod which indicates an overstroke condition when the ring extends out of the brake actuator during actuation of the brakes. The ring may, however, become difficult to see due to the location of the brake actuators and accumulated road debris. The common usage of automatic slack adjusters which incrementally adjusts to compensate for slack in the braking system and to decrease the required push rod movement may further complicate such a system.

[5] Various electronic monitoring systems are also conventionally utilized. Disadvantageously, linkages utilized to actuate the sensor are often complicated and may be relatively fragile. The hostile environment in which the brake actuators are mounted may also damage the electronic systems, particularly where there are exposed components.

[6] Accordingly, it is desirable to provide a brake overstroke indication system which is reliable, inexpensive and readily incorporated into a brake system having an automatic slack adjustment system.

SUMMARY OF THE INVENTION

[7] The vehicle brake assembly according to the present invention provides an indicator system which includes an indicator adjustment shaft biased toward a housing portion such that an indicator post extends through an aperture in the housing portion. An overstroke sensor engages with an adjuster limit arm extending from the indicator adjustment shaft.

[8] When the push rod extends past an overstroke condition, the operating shaft assembly rotates about the pivot axis to rotate a cam member attached thereto against a cam surface which extends from the indicator adjustment shaft. The cam member drives the cam surface member and attached indicator adjustment shaft to overcome the biasing member such that the adjuster limit arm moves away from the overstroke sensor. The overstroke sensor sends a signal to a controller which provides an overstroke indication to a vehicle operator. Simultaneously, the indicator post retracts into the housing portion such that a mechanic is able to visually identify the overstroke condition in a maintenance environment.

[9] Another indicator system includes an overstroke sensor located within the brake housing in an angular position relative the pivot axis adjacent a path of the operating shaft assembly. The overstroke sensor is located such that an end segment of the operating shaft assembly which include a push rod receipt pocket contacts the overstroke sensor when the operating shaft assembly has been rotated to an overstroke condition. Alternatively or additionally, a lever assembly tab extends from the lever assembly opposite the end segment to likewise contact an overstroke sensor.

[10] Another indicator system includes a mechanical overstroke member that buckles in response to contact with an end segment of the operating shaft assembly. The buckled overstroke member is therefore readily identifiable from outside the brake housing such that an operator or mechanic is readily able to visually identify that an overstroke condition has occurred.

[11] The present invention therefore provides a brake overstroke indication system which is reliable, inexpensive and readily incorporated into a brake system having an automatic slack adjustment system.

BRIEF DESCRIPTION OF THE DRAWINGS

[12] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[13] Figure 1 is a cross-sectional end view of a vehicle brake assembly of the present invention;

[14] Figure 2 is a cross-sectional bottom view of a vehicle brake assembly;

[15] Figure 3 is a top partial perspective view of a vehicle brake assembly illustrating a slack adjustment system with an overstroke indicator according to the present invention;

[16] Figure 4 is a top partial sectional view of an overstroke indicator system in a first position;

[17] Figure 5 is a top partial sectional view of the overstroke indicator system of Figure 4 in a second position;

[18] Figure 6 is another overstroke indicator system according to the present invention;

[19] Figure 7 is another overstroke indicator system in a first position; and

[20] Figure 8 is another overstroke indicator system of figure 7 in a second position;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[21] Figure 1 illustrates a partial cross-sectional view of a vehicle brake assembly 10. The vehicle brake assembly 10 includes a housing 12 that may be constructed from one or more housing portions 12a, 12b. A rotor 14 is arranged near or within a portion 12b of the housing 12 and has brake pads 16, or friction elements, arranged on either side of the outer surfaces of the rotor 14.

[22] An actuator 18, typically an air chamber, actuates a brake mechanism 30 to force the brake pads 16 into engagement with the rotor 14. The actuator 18 drives a push rod 20

through a push rod opening 21 to rotate an operating shaft assembly 22 about a pivot axis p. The operating shaft assembly 22 includes a cam 24 having a profile 25 that cooperates with the brake mechanism 30 to drive the brake pads 16. The cam 24 is preferably received at least partially within a bearing block 26 supporting a plurality of needle bearings 28. It should be understood that various actuating systems which are operated by a lever will benefit from the present invention.

[23] The opening 31 of the housing which receives the brake mechanism 30 is closed off on the front side, that is, in the position facing the brake disk, by a closing plate 32 which preferably at least partially supports the brake mechanism 30. The closing plate 32 is attached to the housing 12a by fasteners 34 or the like. Sealing elements are preferably located upon the sealing surfaces between the closing plate 32 and the housing 12.

[24] In operation, upon actuation of the brake pedal by the vehicle operator, a pneumatic output is typically produced by a control module 33 to energize the actuator 18. Heavy-duty vehicle brake assemblies typically include a pair of pistons 36 (Figure 2) that transmit the force generated by the actuator 18 through the push rod 20 and operating shaft assembly 22 to the brake pads 16. It is to be understood that any suitable number of pistons 36 may be used.

[25] After the brakes are actuated, the brake pads 16 must be retracted to prevent the brake pads 16 from dragging on the rotor 14. To this end, a return assembly 38 operates to retract the pistons 36. The return assembly 38 generally includes a plate 40 adjacent a return spring 44. The return spring 44 is arranged between a portion of the housing 12a and the plate 40. The return spring 44 applies a force opposite the actuation force to the plate 40 and into the pistons 36 to retract the brake pads 16.

[26] Referring to Figure 3, a slack adjustment system 46 compensates for movement of the pistons 36 due to wear of the brake pads 16 through interaction between a ball-ended drive pin 35 mounted to the operating shaft assembly 22 and an adjuster shaft 37 as generally understood (Figure 2).

[27] An overstroke indicator system 47 includes an indicator adjustment shaft 48 which mounts an indicator adjuster limit arm 50 which moves with the slack adjustment system 46 along threads 47 (Figure 4) and in response to a gear system 49 to maintain a relative

position. That is, the indicator adjuster arm 50 moves along the indicator adjustment shaft 48 as the brake pads 16 wear and the slack adjustment system 46 compensates therefore (Figure 4).

[28] Referring to Figure 4, the indicator adjustment shaft 48 is biased toward the housing portion 12a with a biasing member 52 such as a spring or the like. The biasing member 52 is captured between a housing portion 12a' and a cam surface member 54 mounted to the indicator adjustment shaft 48 to bias the spring away from housing portion 12a' (illustrated schematically by arrow B). The cam surface member 54 is preferably axially fixed to the adjustment shaft 48 and may be a gear which engages gear system 49.

[29] A stop 56 maintains the axial position of the indicator adjustment shaft 48 against the biasing force of biasing member 52 such that an indicator post 58 extends through an aperture 60 through the housing portion 12a. The indicator post 58 is preferably colored to assist in visual identification.

[30] A overstroke sensor 62 such as a microswitch, reed switch or the like is mounted within the housing portion 12a to engage with the adjuster limit arm 50. When the push rod 20 (Figure 1) extends past an overstroke condition, the operating shaft assembly 22 rotates about the pivot axis p to rotate a cam member 64 attached thereto against the cam surface member 54 (Figure 5). The cam member 64 drives the cam surface member 54 and attached indicator adjustment shaft 48 to overcome the biasing member 52 such that the adjuster limit arm 50 moves away from the overstroke sensor 62. In response to the adjuster limit arm 50 moving away from the overstroke sensor 62 sends a signal to a controller (illustrated schematically at 66) which provides an overstroke indication to a vehicle operator. Simultaneously, the indicator post 58 retracts through the aperture 60 through the housing portion 12a such that a mechanic is able to visually identify the overstroke condition in a maintenance environment. It should be understood that either or both the mechanical and electrical indicator will benefit each brake assembly 10.

[31] Referring to Figure 6, another indicator system 68 includes an overstroke sensor 70 located within the brake housing 12a located in an angular position relative pivot axis p adjacent a path of the operating shaft assembly 22. The overstroke sensor 70 is preferably located such that an end segment 22e of the operating shaft assembly 22 which includes a

push rod receipt pocket 22p contacts the overstroke sensor 70 when the operating shaft assembly 22 has been rotated to an overstroke condition. At the overstroke condition, the overstroke sensor 70 sends a signal to a controller (illustrated schematically at 72) which provides an overstroke indication to a vehicle operator.

[32] Alternatively or additionally, a lever assembly tab 74 extends from the operating shaft opposite the end segment 22e. The lever assembly tab 74 likewise contacts an overstroke sensor 76 which sends a signal to the controller 72 when the operating shaft assembly 22 has been rotated to an overstroke condition. Notably, the sensors are schematically contained within housing portion 12a thereby protecting the sensors from road debris and other hostile environmental conditions. It should be understood that other locations will also benefit from the present invention.

[33] Referring to Figure 7, another indicator system 76 includes a mechanical overstroke member 78. The mechanical overstroke member 78 is preferably a flexible strip which buckles in response to contact with an end segment 22e of the operating shaft assembly 22. Preferably, the mechanical overstroke member 78 is initially, convex relative the interior of the brake housing 12a.

[34] The mechanical overstroke member 78 is located in an angular position relative pivot axis p adjacent a path of the operating shaft assembly 22. When the end segment 22e of the operating shaft assembly 22 reaches an overstroke condition, the end segment 22e contacts the overstroke member 78 which buckles outward or becomes concave relative the interior of the brake housing 12a (Figure 8). The buckled overstroke member 78 is therefore readily identifiable from outside the brake housing 12a such that an operator or mechanic is readily able to visually identify that an overstroke condition has occurred. Furthermore, once the overstroke condition has been corrected, a mechanic need only press inward on the overstroke member 78 to return it to the original (Figure 7) position.

[35] The foregoing description is exemplary rather than defined by the limitations within. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, one of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. It is, therefore, to be understood that within the scope of the

appended claims, the invention may be practiced otherwise than as specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.